

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開平9-107238

(43) 公開日 平成9年(1997)4月22日

(51) IntCl. <sup>6</sup>	識別記号	庁内整理番号	F I	技術表示箇所
H 0 1 Q	21/28		H 0 1 Q	21/28
	1/24			1/24
	1/40			1/40
	11/08			11/08
	13/08			13/08
				A
審査請求 未請求 請求項の数 2 O L (全 5 頁)				

(21) 出願番号 特願平7-262742

(22) 出願日 平成7年(1995)10月11日

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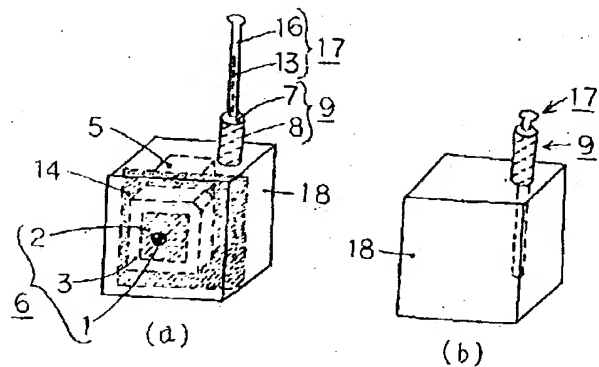
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(54) 【発明の名称】 複合アンテナ装置

(57) 【要約】

【課題】従来、携帯電話等の移動体通信の衛星通信と地上通信の両方の基地局と通信可能な複合アンテナは受信感度を損なう配置になっていた。

【解決手段】円偏波用の平面アンテナ6と直線偏波用のヘリカルアンテナ9と半波長アンテナ17と逆F形アンテナ5からなる複合アンテナで、複合アンテナを衛星通信か地上通信かの状況によりアンテナの姿勢を変化させる。



## 【特許請求の範囲】

【請求項1】円偏波用平面アンテナと、直線偏波用平面アンテナと、前記両平面アンテナが接地部を共用する接地導体板と、前記接地導体板を挟んで両平面アンテナを配置し無線機頭部で回転するアンテナ収納手段とが具備されたことを特徴とする複合アンテナ装置。

【請求項2】前記アンテナ収納手段あるいはこれとは別体に無線機本体側にヘリカルアンテナと、引き出された時、前記ヘリカルアンテナに容量的に結合され、かつ収納された時、前記結合が実質的に解除されるよう適合された伸長可能な半波長アンテナとから成る直線偏波用伸縮アンテナが配置され、前記円偏波用平面アンテナは動作周波数が $f_1$ 、前記直線偏波用の平面アンテナと伸縮アンテナとは動作周波数が $f_2$ であって、衛星通信時に前記円偏波用平面アンテナに切り換わり、地上通信時に前記直線偏波用の平面アンテナと伸縮アンテナとを切り換える少なくとも2個の切り換え手段を具備することを特徴とする請求項1記載の複合アンテナ装置。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】図6(a)、(b)のように、本発明は、携帯用無線機20を用いて衛星32との衛星通信34を行う移動体通信と地上の基地局33との地上通信35を行う移動体通信の両システムに有効なアンテナの配置に関するものである。

## 【0002】

【従来の技術】現在、携帯用無線機(20)(以下、携帯電話)などの移動体通信においては、800MHz帯、1.5GHz帯、1.9GHz帯の直線偏波が用いられている。近年、衛星(32)を用いた携帯電話(20)の構想が各社から提案されており、それらの周波数帯は、地上の携帯電話(20)から衛星(32)へは1.6GHz帯が、衛星(32)から地上の携帯電話(20)へは2.4GHz帯が割当てられているもの、また1.6GHz帯は地上から衛星(32)、衛星(32)から地上の双方向の通信に用いる周波数帯として割当てられているものがある。アンテナ構成として、例えば図7に示すものは、衛星通信(34)には送信用マイクロストリップライン平面アンテナ22(以下、送信用平面アンテナ)と受信用マイクロストリップライン平面アンテナ23(以下、受信用平面アンテナ)を用い、地上の基地局(33)に対しては、直線偏波用の線状アンテナ21に切り換えて用いる方法(ITU研究 世界の非静止衛星通信システム No. 261/262 新日本ITU協会 1993年8月刊行 P. 36)が提案されている。

【0003】以下、図7により従来技術を説明する。ここでは、説明のため上記ITU研究に掲載されているオッテッセイシステム(米国 TRW社)で提案されている線状アンテナ21と平面アンテナ22、23での構成

に沿って述べる。このアンテナ系は、線状アンテナ21と送信用平面アンテナ22と受信用平面アンテナ23とを一体的に備えた折りたたみアンテナアレイ24で、携帯電話20の頭部を中心に背面側に回転し、感度を良好になる任意の角度に固定できる。線状アンテナは周波数 $f_2$ で地上通信(35)に用いる。送信用平面アンテナ22と受信用平面アンテナ23はそれぞれ周波数 $f_1$ 、 $f_3$ を用い衛星(32)と衛星通信(34)を行う。送信・受信の帯域が同じ周波数 $f_1$ の衛星通信システムの場合は、前記平面アンテナのうち一方を送信と受信に兼用すればよい。

## 【0004】

【発明が解決しようとする課題】しかしながら、この折りたたみアンテナアレイ24は、折りたたんだ状態での通信感度や地上通信に対する考慮がなされておらず、折りたたんだ状態での通信感度や地上通信時に動作するアンテナが1つしかなく通信感度の劣化が生じる。

## 【0005】

【課題を解決するための手段】本発明は上述の課題を解決するため、円偏波用平面アンテナと、直線偏波用平面アンテナと、前記両平面アンテナが接地部を共用する接地導体板と、前記接地導体板を挟んで両平面アンテナを配置し無線機頭部で回転するアンテナ収納手段とが具備されるものである。

## 【0006】

【発明の実施の形態】図1～図6は本発明の実施の形態を示す。図において同じ部位は同じ符号で示す。図1に示す5は逆F形アンテナ(直線偏波用の平面アンテナ手段)、6は背面給電方式のマイクロストリップライン平面アンテナ(円偏波用の平面アンテナ手段)、9はヘリカルアンテナ、17は半波長アンテナ、18は複合アンテナの収納手段である。

【0007】本発明の実施形態は、図1のように誘電体の基板3の一方の面にパッチ状の導体2と他方の面に地導体板4と少なくとも1本の給電ピン1を備える背面給電方式のマイクロストリップライン平面アンテナ6(以下、平面アンテナ)と、逆F形アンテナ5と、この平面アンテナ6と逆F形アンテナ5の接地部を共用する接地導体14と、誘電体円筒7に巻かれた螺旋状の導体線8から成るヘリカルアンテナ9と、引き出された時、ヘリカルアンテナ9に容量的に結合され、かつ収納された時、これから実質的に減結合されるように適合された伸長可能な半波長アンテナ17とで複合アンテナを構成する。更に図2のように、この複合アンテナの収納手段18を回転させる複合アンテナの支持体19とを組み合わせることで携帯電話20の頭部で回転するアンテナ装置を構成する。

【0008】ここでは、各々の素子の動作を説明し、さらにそれらの複合アンテナとしての配置、最後に複合アンテナ装置としての動作について説明する。

【0009】まず最初に、平面アンテナ6が図6(b)に示す衛星通信34に用いる円偏波アンテナとして動作する場合について説明する。平面アンテナ6は、図4に示すように、誘電体の基板3にパッチ状の導体2と、他方の面に地導体板4と、給電ピン用の貫通孔15を設け、誘電体の基板3の誘電率、基板3に貼付するパッチ状の導体2の寸法、給電ピン用の貫通孔15の位置等を適切に設計することにより、円偏波アンテナとして動作する。他方の面に設けられた地導体板4は貫通孔15より大きな径に孔が開けられ、貫通孔15に給電ピン1を設けるとパッチ状の導体2に接続し、地導体板4には非接触である。例えば図のように平面アンテナ6に四角形パッチアンテナを設けた場合、使用する周波数帯に依りて平面アンテナ6は1点給電方式のパッチアンテナで長い方の辺と短い方の辺をそれぞれA、Bとすると $100 \times A/B = 102 \sim 103\%$ 程度になるように構成する。給電ピン用の貫通孔15は四角形のパッチ状の導体2の略対角線上に配置する。このとき、長い方の辺Aでは低い周波数で共振し直線偏波特性を示し、短い方の辺Bでは高い周波数で共振し前記楕円偏波と交差した直線偏波特性を示し、それらの間の周波数で円偏波アンテナとして動作する。

【0010】さらに、図4(b)のように給電ピン用の貫通孔15を四角形の対角線上に $100 \times (a-b)/a = 3.0\%$ 程度になるように配置すれば50Ω系のインピーダンス整合がとれ、特性インピーダンス50Ωのインピーダンス整合がとれることが知られている。また誘電体の基板3の厚さ等により帯域幅を設定する。

【0011】次に、平面アンテナ6の地導体板4と接地導体14の一方の面を電氣的に接続し、接地導体14の他方の面に図6(a)に示す地上通信35のダイバーシチに用いる逆F形アンテナ5(図5参照)を電氣的に接続する。

【0012】その次に、ヘリカルアンテナ9は、導体線を誘電体円筒7に巻き、半波長アンテナ17を収納した状態と伸長した状態において、使用する地上通信35での周波数f2で動作するように、ヘリカルアンテナの巻き数や誘電体円筒7の直径を適切に設定する。

【0013】さらに、ヘリカルアンテナ9と同一の周波数帯で動作する半波長アンテナ17はヘリカルアンテナ9の略中心を通り収納及び伸長自在で引き出し時にヘリカルアンテナ9と容量的に結合し、収納時に減結合されるように、線状の導線またはヘリカルアンテナ9の直径以下の直径の導体線または小径巻きのヘリカルアンテナで構成する。

【0014】以上の4つのアンテナ群を1つの収納手段18に収納し、収納手段18を携帯電話20の上端部に配置し、可動させるための支持体19を設ける。以上により衛星通信34をする際には平面アンテナ6が天頂方向を向くようにし、地上通信35をする際には逆F形ア

ンテナ5が携帯電話20の背面になるように可動させる。このように複合アンテナを配置することにより衛星通信34においても、地上通信35においても通信感度を確保することが可能となる。

【0015】本発明の実施形態では4つのアンテナ群を1つの収納手段18に収納したが、2つの収納手段を設け、一方には平面アンテナ6と逆F形アンテナ5を収納し、他方にヘリカルアンテナ9と半波長アンテナ17を設けて、適宜、両方の収納手段または平面アンテナ6の収納手段側のみを可動させても何ら差し支えない。

【0016】図3により本発明の実施形態における動作状況を説明する。

【0017】図3において27は地上通信のダイバーシチに使用する第1の切り換え手段、28は地上通信と衛星通信の切り換えに使用する第2の切り換え手段、Dは半波長アンテナ17とヘリカルアンテナ9との間隔であり、半波長アンテナ17を伸長したときに前記2つのアンテナは間隔Dで容量的に結合し、収納したときには減結合する。点線は各アンテナと携帯電話20の本体に接続するための同軸線である。また、図6(a)(b)に示すようにf1は衛星通信34の周波数、f2は地上通信の周波数である。平面アンテナ6と逆F形アンテナ5は接地導体14によって隔てられる。

【0018】

【発明の効果】以上説明したように本発明によれば、携帯電話20のような小型な携帯用無線機を用いて送信、受信の通信感度を衛星通信34、地上通信35の如何を問わず保つことが可能となる。

【図面の簡単な説明】

【図1】 本発明の実施形態を示し(a)は半波長アンテナ伸長時、(b)は半波長アンテナ収納時の図。

【図2】 本発明の実施形態を示す複合アンテナ装置を搭載した携帯電話の斜視図で、(a)は地上通信時の斜視図、(b)は衛星通信時の斜視図。

【図3】 本発明の実施形態における動作切替え説明する図で、(a)は斜視図、(b)は正面図。

【図4】 マイクロストリップライン平面アンテナの説明図。

【図5】 逆F形アンテナの説明図。

【図6】 移動体通信の説明図。

【図7】 従来例の携帯電話の斜視図。

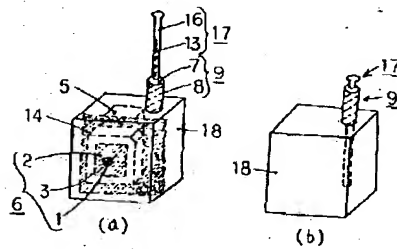
【符号の説明】

- 1 : 給電ピン
- 2 : パッチ状の導体
- 3 : 誘電体(誘電体の基板)
- 4 : 地導体板
- 5 : 逆F形アンテナ(直線偏波用の平面アンテナ手段)
- 6 : マイクロストリップライン平面アンテナ(円偏波用の平面アンテナ手段)
- 7 : 誘電体円筒

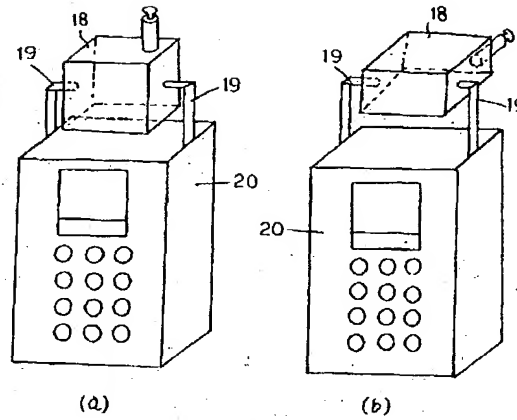
- 8 : 螺旋状の導体線  
 9 : ヘリカルアンテナ  
 10 : 逆F形アンテナの給電点  
 11 : ヘリカルアンテナの給電点  
 12 : 平面アンテナの給電点  
 13 : 半波長アンテナの導体線  
 14 : 接地導体  
 15 : 平面アンテナの給電ピン用の貫通孔  
 16 : 半波長アンテナの保護誘電体  
 17 : 半波長アンテナ  
 18 : 複合アンテナの収納手段  
 19 : 複合アンテナの支持手段  
 20 : 携帯用無線機 (携帯電話)

- 21 : 線状アンテナ  
 22 : 送信用マイクロストリップ平面アンテナ (送信用平面アンテナ)  
 23 : 受信用マイクロストリップ平面アンテナ (受信用平面アンテナ)  
 24 : 折りたたみアンテナアレイ  
 27 : 第1の切り換え手段  
 28 : 第2の切り換え手段  
 32 : 衛星  
 33 : 地上の基地局  
 34 : 衛星通信  
 35 : 地上通信

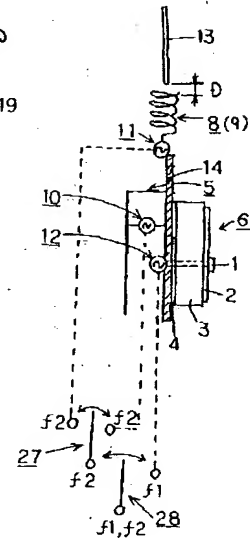
【図1】



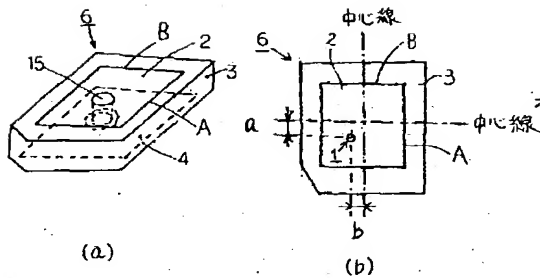
【図2】



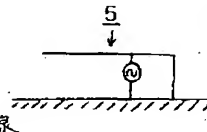
【図3】



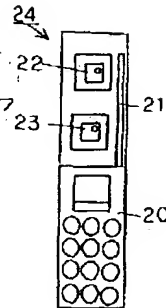
【図4】



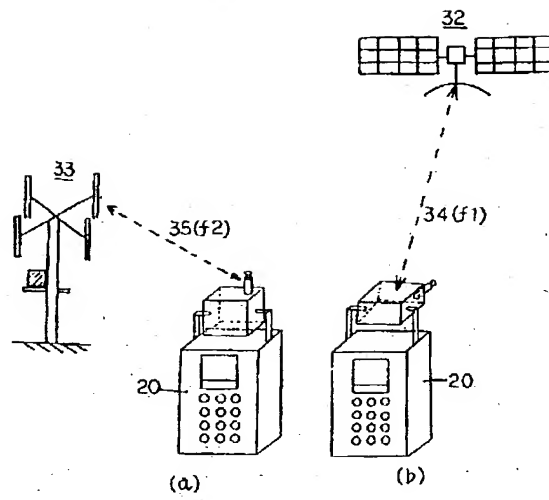
【図5】



【図7】



【図6】



## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 09-107238

(43)Date of publication of application : 22.04.1997

(51)Int.Cl. :

H01Q 21/28

H01Q 1/24

H01Q 1/40

H01Q 11/08

H01Q 13/08

(21)Application number : 07-262742

(71)Applicant : KYOCERA CORP

(22)Date of filing : 11.10.1995

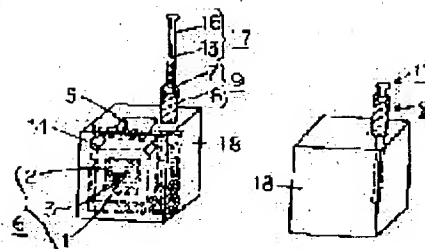
(72)Inventor : SUGURO AKIHIRO  
NAKADA SHINICHI

## (54) COMPOSITE ANTENNA EQUIPMENT

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To keep the communication sensitivity in satellite communication as well as ground communication by arranging a plane antenna for circularly polarized wave and a plane antenna for linearly polarized wave between which an earth conductor plate is interposed and providing an antenna storage means turned by a radio machine head part.

**SOLUTION:** A composite antenna consists of a micro strip line plane antenna 6 in the back feed system, an inverted F type antenna 5, an earth conductor 14 sharing the earth part of the plane antenna 6 and the inverted F type antenna 5, a helical antenna 9, and a half-wave antenna 17. It is stored in a storage means 18, and the storage means 18 is arranged on the upper end part of a portable telephone, and a support body to move it is provided. In the case of satellite communication, the antenna is moved so that the plane antenna 6 is turned to the zenith; and in the case of ground communication, it is so moved that the inverted F type antenna 5 is placed at the rear of the portable telephone. Since the composite antenna is arranged in this manner, the communication sensitivity is secured in satellite communication as well as ground communication.



## LEGAL STATUS

[Date of request for examination]

20.12.1999

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

3122017

[Number of appeal against examiner's decision  
of rejection]

[Date of requesting appeal against examiner's  
decision of rejection]

[Date of extinction of right]

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**CLAIMS**

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[Claim(s)]

[Claim 1] grounding whose flat antenna for circularly-polarized waves, flat antenna for linearly polarized waves, and both aforementioned flat antennas share the grounding section -- a conductor -- a board and the aforementioned grounding -- a conductor -- the compound antenna equipment characterized by what an antenna receipt means to have arranged both flat antennas on both sides of a board, and to rotate in a walkie-talkie head possessed

[Claim 2] Compound antenna equipment according to claim 1 characterized by providing the following. The aforementioned antenna receipt means or this is a helical antenna to the main part side of a walkie-talkie in another object. When are pulled out, and it is combined with the aforementioned helical antenna in capacity and contained, The flexible antenna for linearly polarized waves which consists of the half-wave antenna which suited so that the aforementioned combination might be canceled substantially, and which can be elongated is arranged. The frequency of operation of the flat antenna and flexible antenna of the for [ flat antenna / for circularly-polarized waves / aforementioned ]  $f_1$  and for the aforementioned linearly polarized waves in a frequency of operation is  $f_2$ . At least two switch meanses which switch to the aforementioned flat antenna for circularly-polarized waves, and switch the flat antenna and flexible antenna for the aforementioned linearly polarized waves at the time of ground communication at the time of satellite communication.

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[Translation done.]



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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] As shown in drawing 6 (a) and (b), this invention relates to arrangement of an antenna effective in both the systems of the mobile communications which perform ground communication 35 with the mobile communications which perform satellite communication 34 with a satellite 32 using the portable walkie-talkie 20, and the terrestrial base station 33.

[0002]

[Description of the Prior Art] Now, in mobile communications, such as a portable walkie-talkie (20) (the following, cellular phone), the linearly polarized wave of a 800MHz band, a 1.5GHz band, and a 1.9GHz band is used. The design for the cellular phone (20) using the satellite (32) is proposed from each company in recent years. those frequency bands That by which the 2.4GHz band is assigned to the satellite (32) from the satellite (32) from the terrestrial cellular phone (20) to the cellular phone (20) of the ground [ band / 1.6GHz ]. Moreover, a 1.6GHz band has some which are assigned from the ground as a frequency band used for terrestrial bidirectional communication from a satellite (32) and a satellite (32). As antenna composition, for example, the thing shown in drawing 7 To satellite communication (34), the microstrip-line flat antenna 22 for transmission A terrestrial base station (33) is received using (the flat antenna for the following and transmission), and the microstrip-line flat antenna 23 (flat antenna for the following and reception) for reception. the line for linearly polarized waves -- the method (the non-geostationary satellite in the ITU research world communication system No.261 / 262 New ITU Association of Japan August, 1993 publication P.36) of switching and using for an antenna 21 is proposed

[0003] Hereafter, drawing 7 explains the conventional technology. the line proposed here by ODDESSEISHISUTEMU (U.S. TRW, Inc.) carried by the above-mentioned ITU research for explanation -- it states along with the composition in an antenna 21 and flat antennas 22 and 23 this antenna system -- a line -- it folds up, and it is an antenna array 24, and it rotates to a tooth-back side focusing on the head of a cellular phone 20, and sensitivity can be fixed to the arbitrary angles which were equipped with the antenna 21, the flat antenna 22 for transmission, and the flat antenna 23 for reception in one and which become good a line -- an antenna is used for ground communication (35) on frequency f<sub>2</sub> The flat antenna 22 for transmission and the flat antenna 23 for reception perform a satellite (32) and satellite communication (34) using frequency f<sub>1</sub> and f<sub>3</sub>, respectively. What is necessary is just to use one side also [ reception / transmission and ] among the aforementioned flat antennas, when the band of transmission and reception is the satellite communication system of the same frequency f<sub>1</sub>.

[0004]

[Problem(s) to be Solved by the Invention] However, the consideration to the communication sensitivity in the state where it folded up, or ground communication is not made, but there is only one antenna which operates at the time of the communication sensitivity in the state where it folded up, or ground communication, and degradation of communication sensitivity produces this folding antenna array 24.

[0005]

[Means for Solving the Problem] grounding whose flat antenna for circularly-polarized waves, flat antenna for linearly polarized waves, and both aforementioned flat antennas share the grounding section in order that this invention may solve an above-mentioned technical problem — a conductor — a board and the aforementioned grounding — a conductor — an antenna receipt means to arrange both flat antennas on both sides of a board, and to rotate in a walkie-talkie head possesses

[0006]

[Embodiments of the Invention] Drawing 1 — drawing 6 show the gestalt of operation of this invention. In drawing, the same sign shows the same part. For a reverse F type antenna (flat antenna means for linearly polarized waves), and 6, as for a helical antenna and 17, the microstrip-line flat antenna (flat antenna means for circularly-polarized waves) of a tooth-back electric supply method and 9 are [ 5 shown in drawing 1 / a half-wave antenna and 18 ] the receipt meanses of a compound antenna.

[0007] the operation gestalt of this invention — drawing 1 — like — one field of the substrate 3 of a dielectric — the patch-like conductor 2 and the field of another side — the ground — a conductor — a tooth-back electric supply method equipped with a board 4 and at least one electric supply pin 1 microstrip-line flat antenna 6 grounding which shares the grounding section of (the following, a flat antenna), the reverse F type antenna 5, and the this flat antenna 6 and the reverse F type antenna 5 — with a conductor 14 the spiral conductor wound around the dielectric cylinder 7 — a compound antenna consists of half-wave antennas 17 which suited so that it might be substantially decoupled with the helical antenna 9 which consists of a line 8 after this, when it is combined by the helical antenna 9 in capacity when pulled out, and contained and which can be elongated Furthermore, the antenna equipment which rotates in the head of a cellular phone 20 like drawing 2 combining the base material 19 of a compound antenna which rotates the receipt means 18 of this compound antenna is constituted.

[0008] Here, operation of each element is explained and operation as compound antenna equipment is further explained to the arrangement as those compound antennas, and the last.

[0009] The case where it operates as a circularly-polarized-wave antenna which a flat antenna 6 uses for the satellite communication 34 shown in drawing 6 (b) first is explained. a flat antenna 6 is shown in drawing 4 — as — the substrate 3 of a dielectric — the patch-like conductor 2 and the field of another side — the ground — a conductor — it operates as a circularly-polarized-wave antenna by forming a board 4 and the breakthrough 15 for electric supply pins, and designing appropriately the position of the dielectric constant of the substrate 3 of a dielectric, the size of the conductor 2 of the shape of a patch stuck on a substrate 3, and the breakthrough 15 for electric supply pins etc. the ground established in the field of another side — a conductor — if a hole can open a board 4 in a bigger path than a breakthrough 15 and the electric supply pin 1 is formed in a breakthrough 15 — the patch-like conductor 2 — connecting — the ground — a conductor — it is non-contact at a board 4 For example, as shown in drawing, when a square patch antenna is formed in a flat antenna 6, if a flat antenna 6 sets the side of the longer one, and the side of the shorter one to A and B with the patch antenna of an one-point electric supply method according to the frequency band to be used, respectively, it constitutes so that it may become about  $100 \times A/B = 102-103\%$ . The breakthrough 15 for electric supply pins is arranged on the abbreviation diagonal line of the conductor 2 of the shape of a square patch. At this time, it resonates on low frequency and a linearly-polarized-wave property is shown, and in the side B of the shorter one, the linearly-polarized-wave property which resonated on high frequency and intersected the aforementioned elliptically polarized wave is shown, and it operates as a circularly-polarized-wave antenna on the frequency between them in the side A of the longer one.

[0010] Furthermore, it is known that the impedance matching of 50-ohm system can be taken if the breakthrough 15 for electric supply pins is arranged like drawing 4 (b) so that it may become  $100 \times (a-b) / \text{about } a \approx 30\%$  on the square diagonal line, and the impedance matching which is the characteristic impedance of 50ohms can be taken. Moreover, bandwidth is set up with the thickness of the substrate 3 of a dielectric etc.

[0011] next, the ground of a flat antenna 6 — a conductor — a board 4 and grounding — one field of a conductor 14 — electric — connecting — grounding — the reverse F type antenna 5 (refer to drawing 5) used for the diversity of the ground communication 35 shown in the field of another side of a conductor 14 at drawing 6 (a) is connected electrically

[0012] the degree — a helical antenna 9 — a conductor — a line is coiled around the dielectric cylinder 7, and in the state where it elongated with the state where the half-wave antenna 17 was contained, the number of turns of a helical antenna and the diameter of the dielectric cylinder 7 are appropriately set up so that it may operate on the frequency  $f_2$  in the ground communication 35 to be used

[0013] furthermore, the half-wave antenna 17 which operates by the same frequency band as a helical antenna 9 — the abbreviation center of a helical antenna 9 — a passage — receipt and extension — free — the time of a drawer — a helical antenna 9 and capacity — like — joining together — the time of receipt — decoupling — having — as — the conductor of the diameter below a linear lead wire or the diameter of a helical antenna 9 — it constitutes from a helical antenna of a line or a minor diameter volume

[0014] The above four antenna groups are contained for one receipt means 18, and the base material 19 for arranging and carrying out movable [ of the receipt means 18 ] to the upper-limit section of a cellular phone 20 is formed. In case satellite communication 34 is carried out by the above, it is made for a flat antenna 6 to turn to the direction of a zenith, and in case ground communication 35 is carried out, it carries out movable so that the reverse F type antenna 5 may become the tooth back of a cellular phone 20. Thus, also in satellite communication 34, it becomes possible by arranging a compound antenna to secure communication sensitivity also in the ground communication 35.

[0015] Although four antenna groups were contained for one receipt means 18 with the operation gestalt of this invention, two receipt meanses are established, to one side, a flat antenna 6 and the reverse F type antenna 5 are contained, and a helical antenna 9 and a half-wave antenna 17 are formed in another side, and even if it carries out movable [ only of receipt meanses / both / side or the receipt means side of a flat antenna 6 ], it does not interfere at all suitably.

[0016] Drawing 3 explains the situation of operation in the operation gestalt of this invention.

[0017] The 1st switch means which uses 27 for the diversity of ground communication in drawing 3, the 2nd switch means which uses 28 for a switch of ground communication and satellite communication, and D are the intervals of a half-wave antenna 17 and a helical antenna 9, and when the two aforementioned antennas are combined in capacity at intervals of D when a half-wave antenna 17 is elongated, and it contains, they are decoupled. A dotted line is a coaxial line for connecting with the main part of each antenna and a cellular phone 20. Moreover, as shown in drawing 6 (a) and (b),  $f_1$  is the frequency of satellite communication 34, and  $f_2$  is the of ground communication. a flat antenna 6 and the reverse F type antenna 5 — grounding — it is separated by the conductor 14

[0018]

[Effect of the Invention] As explained above, according to this invention, it becomes possible to maintain the communication sensitivity of transmission and reception regardless of how of satellite communication 34 and the ground communication 35 using a small portable walkie-talkie like a cellular phone 20.

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[Translation done.]

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DESCRIPTION OF DRAWINGS

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## [Brief Description of the Drawings]

[Drawing 1] The operation gestalt of this invention is shown and, for (a), (b) is drawing at the time of half-wave antenna receipt at the time of half-wave antenna extension.

[Drawing 2] At the perspective diagram of a cellular phone which carried the compound antenna equipment in which the operation gestalt of this invention is shown, (a) is a perspective diagram at the time of ground communication, and (b) is a perspective diagram at the time of satellite communication.

[Drawing 3] In drawing in the operation gestalt of this invention which gives change explanation of operation, (a) is a perspective diagram and (b) is front view.

[Drawing 4] Explanatory drawing of a microstrip-line flat antenna.

[Drawing 5] Explanatory drawing of a reverse F type antenna.

[Drawing 6] Explanatory drawing of mobile communications.

[Drawing 7] The perspective diagram of the cellular phone of the conventional example.

## [Description of Notations]

- 1: Electric supply pin
- 2: Patch-like conductor
- 3: Dielectric (substrate of a dielectric)
- 4: the ground -- a conductor -- a board
- 5: Reverse F type antenna (flat antenna means for linearly polarized waves)
- 6: Microstrip-line flat antenna (flat antenna means for circularly-polarized waves)
- 7: Dielectric cylinder
- 8: a spiral conductor -- a line
- 9: Helical antenna
- 10: The feeding point of a reverse F type antenna
- 11: The feeding point of a helical antenna
- 12: The feeding point of a flat antenna
- 13: the conductor of a half-wave antenna -- a line
- 14: grounding -- a conductor
- 15: The breakthrough for the electric supply pins of a flat antenna
- 16: The protection dielectric of a half-wave antenna
- 17: Half-wave antenna
- 18: The receipt means of a compound antenna
- 19: Support means of a compound antenna
- 20: A portable walkie-talkie (cellular phone)
- 21: a line -- an antenna
- 22: The micro-stripe flat antenna for transmission (flat antenna for transmission)
- 23: The micro-stripe flat antenna for reception (flat antenna for reception)
- 24: Folding antenna array
- 27: The 1st switch means
- 28: The 2nd switch means
- 32: Satellite

- 33: A terrestrial base station
- 34: Satellite communication
- 35: Ground communication

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[Translation done.]

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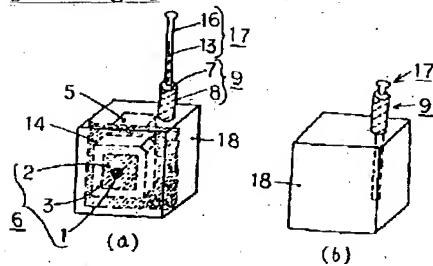
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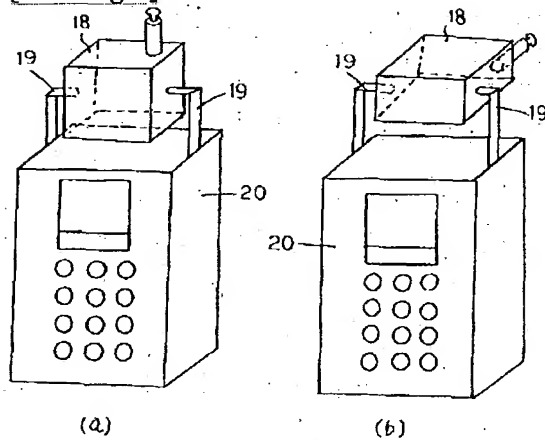
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## DRAWINGS

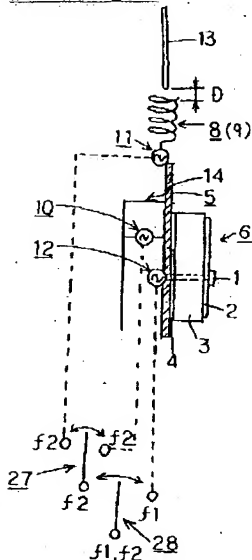
[Drawing 1]



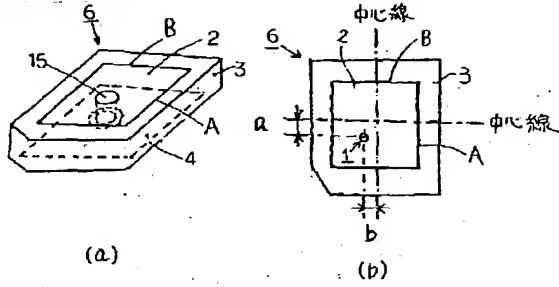
[Drawing 2]



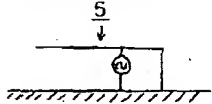
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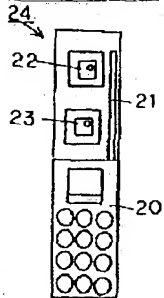
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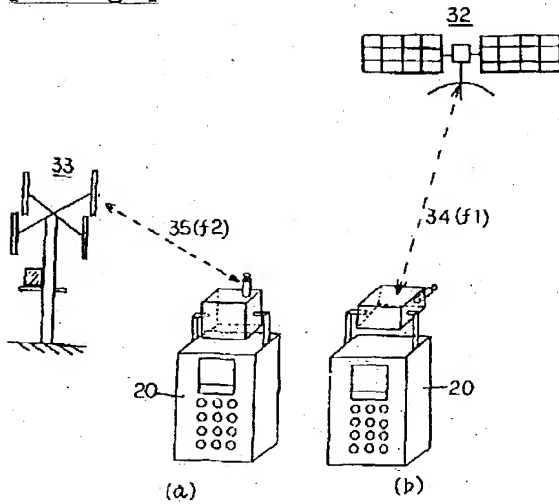
[Drawing 5]



[Drawing 7]



[Drawing 6]



[Translation done.]